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Bulk in Animal Feeding.

By E. Alfred West, F.R.C.V.S.

The debatable questions which arise in connection with the important subject of the feeding of farm animals have received during the past year welcome attention and study by the scientist, the agriculturalist and the members of our own profession. It is, therefore, of great interest briefly to refer to some of the results of such work which have appeared in the pages of the *Veterinary Record* and elsewhere.

Early in the past year we had a highly courageous and boldly-expressed paper from Boutflour, at Birmingham, entitled "The Management of Cows for High Milk Yields," and his views may be summarised as being in favour of the recognition of two rations, one for maintenance and the other for production. He deprecated overloading the stomach by giving large quantities of hay and chaff and succulent foods, and advocated increasing the concentrates and provision of unlimited drinking water. An excellent debate followed and the debaters clearly showed how much difference of opinion existed on these matters, experience having proved that districts and even individual animals required feeding arrangements suited to localities and temperaments. Boutflour's methods had been highly successful in some places, but in others much less so. The theory of universal dietaries did not receive unanimous support. Questions were asked, but unanswered, as to what was to be done with the hay and roots which the farmer had no choice but to grow.

A few weeks later Professor Linton presented a paper to the Lancashire Division at Manchester, and some of his views were more or less in conflict with Boutflour's for, whilst the Professor was in agreement with the increasing of concentrates, he stressed the benefits of roots and hay. Again, this paper was followed by a well-sustained discussion which showed how much there is to be learnt about animal feeding and nutrition.

Following on these contributions, we have a reprint from *The Journal of Agricultural Science* in which, under the heading of "Bulk in Animal Feeding," two investigators—Procter and Wright—give the results of experiments they have been making in the laboratory and in the feeding of calves and young pigs, with the object of determining or measuring the bulk occupied by equal weights of different foods in the stomach. In their experimental work the writers followed the simple method of soaking foods in water at body temperature, and later feeding trials were carried out to determine whether the volume occupied on entering the stomach would be a limiting factor in the consumption of food. Such further questions as:—

At what rate does swelling take place?

To what extent do dry foods swell when entering the stomach?

What are the factors causing variations in swelling? and Can bulk limit consumption? have been closely studied by them.

They describe foods as having high and low-swelling properties and they remark that, so far as feeding in bulk is concerned, a small weight of certain foodstuffs is as bulky as a large weight of roots and water. Highly informative, this! It is clearly pointed out by these observers that the work done is experimental, and therefore it follows that were criticism possible it would at this stage be both purposeless and invalid.

I am, therefore, limited to these sketchy remarks, but I may serve some little purpose by attempting to focus the attention of members and others to the immense importance of the subject, and by emphasising the enormous possibilities which lie before the present and future generations through altered and improved methods in the feeding of farm and domestic animals. It may well be that herein is one of the solutions of the ever-pressing and depressing problems of the heavily-burdened agriculturalist. The lay Press gives considerable space each week to our medical brethren for the airing of their views on the correct dieting of the human subject. Let not the veterinary surgeon lag behind—his opportunities are prodigious! It is devoutly to be hoped that the scientist, the members of our own body, and the farmer may find some means of working together in their respective spheres for the furtherance of knowledge in regard to the more judicious and economical feeding of our livestock. In the 'eighties and 'nineties, when horses played a more important part than they do to-day in the nation's transport, many large industrial concerns owning big studs, depended to a great extent on the forage department for their prosperity and the veterinary surgeon was the official who was relied upon to give advice and assistance. Whether he is similarly called upon to-day to advise on the feeding of farm stock is doubtful.

Medical Journalism.

"The approaching resignation of Sir Dawson Williams from the editorship of the *British Medical Journal* is a matter of public as well as of professional regret," says *The Times*, in a leading article. "During thirty difficult years Sir Dawson has represented all that is best, most sane, and most progressive in modern medicine. To his lot it fell to mould and form the ideas of the great majority of doctors in this country during the time in which science entered into partnership with clinical study. Many heads were turned in these days and false prophets abounded; but the *British Medical Journal*, while welcoming the new, at no time lost sight of the value of the old. Sir Dawson Williams held steadily before his readers the importance of research work carried out at the bedside; he was the first medical editor to recognise the significance of the discoveries of the late Sir James Mackenzie; his columns did more perhaps than any other agency to direct the interest of practising physicians into scientific channels and, at the same time, to remind workers in laboratories that the proper study of mankind is man."

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The Physiology of Milk Fever.*

By PIERRE A. FISH, Ithaca, N. Y.

Reprinted from the *Cornell Veterinarian*, April, 1927.

It is a safe assumption that no such disease as milk fever existed two or three centuries ago. Not until the middle of the eighteenth century, when improved methods of agriculture had come into existence and an interest had been aroused in the physiology of breeding and feeding cattle, and not until cows of superior milking qualities had been developed, at a later period, could this disease reasonably have been expected to exist. Since its origin is associated with the advance of civilisation and the application of civilized methods to our domesticated animals, it may, more or less appropriately, be referred to as a civilised disease: and, further, since its recognition as a disease entity, its causation has been subject to so many theories that it may also be referred to as a "disease of theories."

According to Greig, milk fever seems to have been recognised and recorded since the early part of the nineteenth century, in Great Britain. Price (1806) and Skellet (1807) were among the first to describe the disease. Price recommended sweating by the use of hot packs and blanketing. In 1883 Cox and later Russel recommended the same procedure, claiming excellent results. In eight cases which recovered, five were *in extremis*.

Schmidt's treatment, originating in 1897, and consisting of the injection into the udder of a one per cent. solution of potassium iodide, was an epoch-making discovery, and reduced the mortality to a much lower point. It was found, however, that different percentages of the salt could be used as well as different (increased) amounts of the solution with effectiveness and that other agents, even water alone, acted favourably.

Andersen, of Skanderborg, is said to have been the first to practice the inflation of the udder with air alone, and this method, at the present time, is universally used.

Some of the theories still in existence, with more or less supporting evidence and more or less adherents, are auto-intoxication, circulatory disturbance, infection, anaphylaxis, and endocrine disfunction. At present much interest centres upon the so-called hypoglycæmic (reduced blood sugar) theory, and it is because numerous points of physiological importance are involved, that the preparation of this paper was undertaken.

In 1923 M. Neefs, a Belgian veterinarian, in a report on insulin, stated that a Canadian veterinarian, whose name unfortunately was not recorded, was so impressed with the similarity of the symptoms observed in experimental hypoglycæmia induced by insulin, with those observed in milk fever, that he submitted the matter to a practical test by injecting a solution of glucose into a cow suffering from milk fever and effected a cure.

Further work has been carried on along this line by Widmark and Carlens, of Sweden, Auger, of Lyon, France, and Maguire, of England, who reports the successful use of the glucose solution in the treatment of the disease. Widmark and Carlens have gone into the work in considerable detail and certain of their results have been confirmed by Auger. A brief summary of the work of these investigators is somewhat as follows: by the experimental use of insulin, Widmark and Carlens were able to bring the amount of sugar in the blood to so low a level (hypoglycæmia) in two experimental cows, as apparently to reproduce the symptoms of milk fever including the characteristic attitude of the head turned round on the chest, and subnormal temperature. M. Auger succeeded in inducing hypoglycæmic symptoms by the use of insulin in three out of six experimental cows. In cases of milk fever, tests of blood, taken before treatment was administered, showed a low content of sugar. Blood taken at fifteen-minute or half-hour intervals, after treatment had been applied, showed an increase in the sugar content up to the sixtieth minute with a return to the normal amount at about the ninetieth minute.

The normal standard of sugar in the blood is definitely lower in the cow, goat, and sheep than in the blood of man or dog. Hayden and Sholl, working on a herd consisting mostly of milch cows and an occasional dry cow and one bull, found an average of 75 tests from 44 cows to be 51·75 milligrams of sugar to 100 cc. of blood. Widmark and Carlens give 60 mg. per 100 in milk cows and 80 mg. per 100 in dry cows and heifers. Auger agrees with the figures of Widmark and Carlens. Each group of investigators followed different methods. Hayden and Sholl used the Folin-Wu test; Widmark and Carlens, the Bang micrometric, and Hagedorn — Jensen methods, and Auger, the Bertrand method. Widmark and Carlens and Auger find that the level of the sugar in the blood must fall to 40 mg. or lower before the hypoglycæmic disturbance occurs.

In a recent paper, published in August, 1926 (*Berliner Tier. Wochenschrift*), Professor Widmark cites seven cases of milk fever. The first three cases are reported as mild, and the blood tests show 36, 33, and 38 mg. of sugar per 100 cc. of blood respectively. Cases 4, 5, and 6 were in coma or near coma; the blood tests showed 124, 131, and 112 mg. per 100, and the urine showed reduction tests equivalent to 2·24, 1·84 and 0·88 per cent. glucose. In case 7 the blood sugar test is not reported, but the reduction test of the urine was equivalent to 0·46 per cent. glucose.

The high blood sugar tests are accounted for by the supposition that some lactose has been absorbed into the blood from the udder. During pregnancy there may be some lactose in the urine, also at the time of calving and for a time thereafter. It is, of course, obvious that the milk sugar could not reach the urine except through transportation by the blood. In other words, it is assumed that the glucose in the blood is low and the high readings are due to the amount of lactose present, but if there is glucose in the urine it is difficult to account for its presence on this basis. The tests used for the determination of sugar do not differentiate as to the kind of sugar present—glucose or lactose, and, as Professor Widmark observes, this is the weakest part of the theory. He also states that a necessary condition for the accuracy of the theory (hypoglycæmia) is the proof that the grape sugar content of animals suffering from parturient paresis is actually as low as that required to induce hypoglycæmic symptoms. From the figures given in these seven cases it would appear

* Presented at the 19th Veterinary Conference, N. Y. State Veterinary College, January 13th, 1927.

that the low sugar tests were found only in the mild cases and in the severer cases in, or near, coma, the sugar had increased nearly 400 per cent. It might be expected, if a hypoglycæmia is the causative factor, that as the symptoms grow worse, the sugar content of the blood would fall to a still lower level instead of increasing in amount. Four cases are also cited in which were used from three to five litres of a 5 per cent. glucose solution intravenously. All four were upon their feet within an hour. After another hour the udder was inflated since "a recurrence was not impossible." This would seem to indicate that there was not over-confidence that the glucose would effect a complete cure. In the case of the unknown Canadian and Maguire, of England, it does not appear that any further treatment than the glucose injection was employed. There seems to be evidence of the curative effect of glucose solutions in milk fever, but more is desirable. A dose of 20 grams or larger of the glucose in solution intravenously has been recommended; subcutaneously the effects are slower. A larger dose of the glucose would not be harmful as the excess glucose would overflow into the urine.

The universally accepted and simplest cure for milk fever is the inflation of the four quarters of the udder with air and the question naturally arises, how can this be correlated with a change in the sugar content of the blood? In the first place, tests of the blood at fifteen or thirty minute intervals show that an increase of sugar actually occurs. Although some of the increased sugar in the blood may be lactose absorbed from the milk, there may also be an increase in the glucose content as well, and this increase may have some influence in correcting the trouble.

It is generally accepted that after udder inflation the pressure upon the mammary cells is sufficient to check their activity and the mammary gland is, therefore, temporarily without function as a secreting organ. This is corroborated by the fact that it may require a day or two for the normal yield of milk to be regained. The temporary absence of mammary function is supposed to check or diminish the conversion of glucose into lactose.

Lactose is the least variable constituent of the milk. It averages around 5 per cent.—50 grams to the litre. Even in insulin experiments this percentage is quite closely maintained. (Giusti and Rietti, Nitzescu and Nicolau.) Since lactose is a double sugar (disaccharid) and glucose a single sugar (monosaccharid) twice as much glucose is used to produce half as much lactose; for every 50 grams of lactose in the milk 100 grams of glucose from the blood are required. The mammary cell converts a portion of the glucose into galactose (a monosaccharid) and then combines these two single sugars, galactose and glucose into the disaccharid lactose, or, as Porcher has termed it, a galactoside of glucose. A fermentable sugar, glucose, is converted into lactose, a sugar not readily fermentable by ordinary yeast.

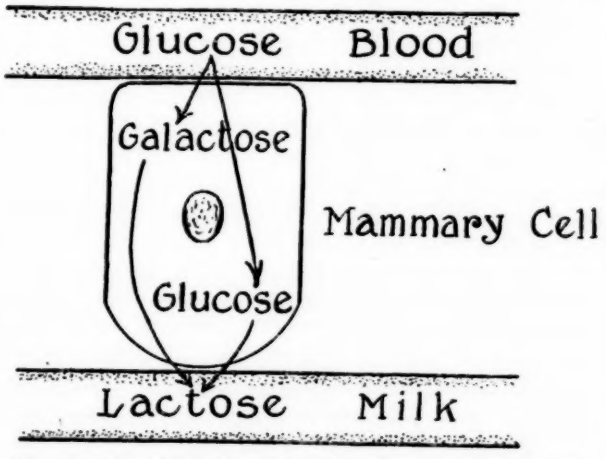

Fig. 1.—A schematic arrangement of the supposed method by which glucose is converted into lactose.

Galactose does not occur in plants nor is it said to occur in animal tissues except in the mammary gland and nerve tissue. When milk is taken as a food the lactose is split into its two constituents and these are absorbed. Sugar in the body is a most important food and is used by all of the tissues and organs, and the amount of sugar thus used is considerable. If the observations of Widmark and Carlens and Auger are correct, ordinary lactation lowers the standard of the sugar content of the blood in milk cows, as compared with that of heifers and the dry condition. After the strain of parturition and the breaking forth of the milk secretion there is a sudden demand for the blood sugar to produce lactose, especially in heavy milkers, and it is usually the heavy milkers that are afflicted with milk fever.

The evidence thus far produced favourable to the hypoglycæmic theory is: first, intravenous injections of glucose into cows suffering from milk fever have restored them to the normal condition; second, a condition simulating the appearance of milk fever as to coma, characteristic position of the body and subnormal temperature has been induced experimentally by the use of insulin which reduces the amount of sugar in the blood; third, there is an increase in the sugar content of the blood following treatment, either by udder inflation or by glucose injection. The glucose solutions, however, have generally been used in considerable amount, 3-5 litres, and this bulk of fluid added to the blood of the body undoubtedly produces a stimulating effect upon the circulation; the inflation of the udder likewise has a stimulating effect perhaps to a different degree with perhaps the absorption of some atmospheric oxygen, but the improvement in the circulation is to be reckoned with, at least, as a contributory factor. Although the evidence already produced has significance it is apparent that gaps still exist and more evidence is needed to make the hypoglycæmic theory secure.

Through the co-operation of our ambulatory and consulting clinics, *data* have been obtained from seven cows suffering from milk fever. Hayden and Sholl's average of 52 mgms. of blood sugar per 100 cc. of blood has been accepted as the normal standard because it represents the average of a large number of tests extending over a long period of time. The Folin-Wu sugar test is generally accepted in this country at least, and as it has been perfected from time to time as to its accuracy and purity of reagents the tendency has been to show a decreased amount of sugar. The blood was collected in vials containing a small piece of dry cloth which had previously been saturated in a solution of lithium oxalate and served the purpose of preventing coagulation, as recommended by Folin.

Concise reports of the cases examined are as follows:

Case No. 1. October 7th, 1926. *Data* incomplete. Cow 8 years old. Temperature 102·5° F.

Case No. 2. October 10th, 1926. Pure-bred Jersey cow. Had an attack of milk fever a year ago, 7½ years old. Down when examined. Temperature 100·6° F. Pulse 72. Respiration 28.

Case No. 3. October 13th, 1926. Jersey cow, 12 years old. Bull calf previous afternoon. Somewhat bloated. Semi-conscious. Expiratory snore. Urine drawn off. No bowel movement. Temperature 101° F. Pulse 65-70.

Case No. 4. October 23rd, 1926. Grade Holstein, 8 years old. Calved 12 hours previous to call. Temperature 101·5° F. Pulse 62.

Case No. 5. October 29th, 1926. Jersey cow, 6 to 8 years old. Calved two days before. Retained placenta, removed by owner. Cow was down when called. Somewhat delirious. Temperature 100° F. Respiration increased.

Case No. 6. December 31st, 1926. Cow was still up but went down shortly. Pulse 80. Respiration 20. Urine alkaline ; sugar present.

Case No. 7. January 12th, 1927. Jersey cow, 5 years old. Had suffered an attack before. Breathing normal. One quarter had been sucked dry by the calf.

A brief report of the blood sugar found is as follows :

TABLE I.

Date	Cases	Pre-inflation mgms. —100 cc.	Post-inflation 10—25 mins. mgs.— 100	30—55 mins. mgs.— 100	60—85 mins. mgs.— 100	105—115 mins. mgs.— 100 cc.
Oct. 7/26	No. 1	68·7	109·6	137·5		
Oct. 10/26	No. 2	70·7				
Oct. 14/26	No. 3	62·2	81·3	131·1		
Oct. 23/26	No. 4	45	73·3	87·1		
Oct. 29/26	No. 5	77·8	111·5	108	99·6	87
Dec. 31/26	No. 6	62·7	77·7	113·4	119·4	74·7
Jan. 13/27	No. 7	49	60	64	62·1	Reinflated
Average of 7 cases		62·3	85·5	106·8	93·7	80·8

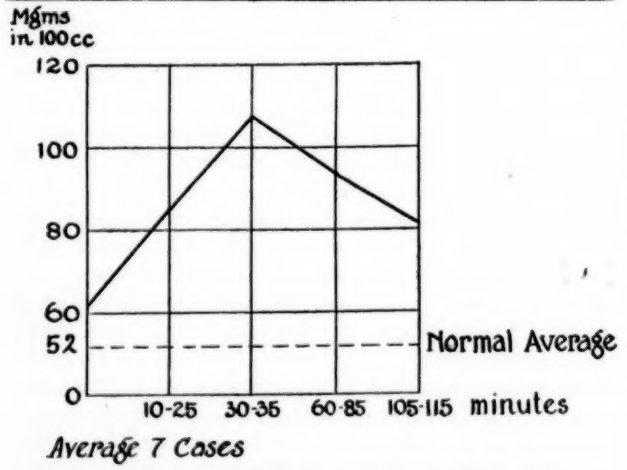

Fig. 2.—The curves of the blood sugar obtained from the average of seven cases of milk fever.

From the average, the curve in Fig. 2 is constructed. Cases 4 and 7 are the only ones in which the pre-inflation sugar was below our normal average, and these are within the zone of what we regard as the normal fluctuation of the blood sugar in the milk cow (40 to 60 mg.). All of the other cases are above Widmark's standard of 60 mg. for the milch cow, and show an increased amount of blood sugar before treatment was begun rather than a hypoglycæmia. If hypoglycæmic disturbances are not manifested until the blood sugar falls below 40 mg. these cases are still within the safety zone.

In an article published in the *Journal of Biological Chemistry*, October, 1926, Vol. 70, pp. 405-426, Folin and Svedberg describe a process by which the fermentable sugar (glucose) can be removed from the blood by the use of yeast. " To 20 cc. of the blood filtrate (which must not contain toluene, sodium fluoride, or other preservative) is added one-quarter of a fresh Fleischmann yeast cake (3·25 gm.). The mixture is shaken vigorously so as to produce a uniform suspension and the flask is then immersed in water at 37-40° C., and after some shaking to promote the rise in temperature is left in the water bath for seven to eight minutes. This short fermentation is quite adequate for the removal of the fermentable sugar, and prolonged fermentations are undesirable in that they tend to increase the blank and give more residual reduction than does the shorter period. At the end of the fermentation period a small teaspoonful (1·75 gm.) of kaolin is added; the mixture is again shaken, cooled, and filtered through a quantitative filter paper. This simple, rapid, process for removing the fermentable sugar gives perfectly dependable, uniform results both with blood filtrates and with correspondingly dilute sugar solutions.

" For the determination of the minute amounts of colour-giving materials in the filtrate, it is, of course, necessary to use very dilute standard sugar solutions (0·025 mg. per cc.), and it is also necessary to turn the colorimetric reflector that only a little light passes up through the colorimetric cups. It is also important that the molybdate reagent should be substantially colourless. With these precautions,

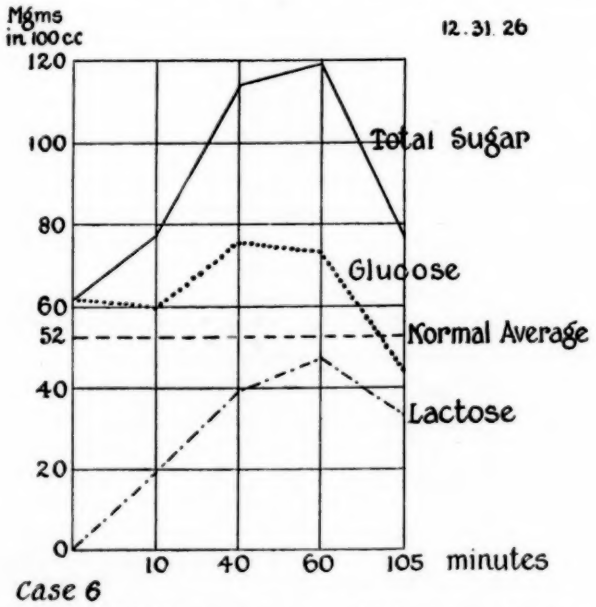

Fig. 3.—The blood sugar curve obtained from Case 6, shows the result of the fermentation test. The upper curve (total sugar) indicates the results as ordinarily obtained. The lower curve (lactose) shows the results after fermentation test had been applied. The intermediate dotted curve (glucose) indicates the sugar that had been fermented out and was obtained by subtracting the lower from the upper curve. Note that the rise in the upper curve (after inflation) is due mainly to the absorption of lactose.

however, the sugar values of the fermented filtrates can be determined by our reagents with an astonishing degree of accuracy." This method was tested out in our laboratory by Dr. C. E. Hayden, by adding a known quantity of lactose to normal blood. The result was satisfactory. The method was also applied to the blood of five normal cows, and subsequent tests showed only the faintest trace of reducing substance, said to be present in normal blood. Similar results were obtained from five samples taken from a cow which had received an injection of normal saline solution. It was not possible to apply the method to the blood of a milk fever patient until December 31st, 1926 (Case 6) and the results are shown graphically in the curve of Fig. 3. The total amount of sugar in the blood is represented in the upper curve. After the fermentation method had been applied to the blood filtrate, tests showed the presence of a reducing sugar which is regarded as lactose, as that sugar is not readily fermentable by ordinary yeast. The lower curve represents the lactose left in the blood after the glucose had been fermented out. Normal blood is said to contain a slight amount of reducing substance. It is likely that the glucose and lactose curves are not strictly accurate, as no allowance was made for these unknown sugars. The glucose curve was constructed by subtracting the lactose curve from the total sugar curve, assuming that all of the glucose had been fermented out.

The pre-inflation sample of blood after fermentation showed the merest trace of reducing substance present which may have been lactose or the small amount of reducing substance normally in the blood. It is also inferred that all of the glucose had disappeared and that not more than a trace of lactose is present in the blood before inflation. Even when lactose is present in the blood in slight traces it develops a lactosuria, so that the concentration of the lactose is much greater in the urine than in the blood. As is well known, urea is present in the blood only to the extent of about 0·01 per cent. but is present in the urine, on the average, at about 2·5 per cent. A concentrated solution of urea is developed from a dilute material in the blood through the activity of the renal cells.

In the ten-minute period, Fig. 3, the decrease in the amount of glucose is so slight as to be within the limit of error, but there is the appearance of lactose showing a noticeable rise and indicating quite a rapid absorption from the milk into the blood. For the next fifty minutes there is an increase of both sugars but the gain is decidedly in favour of the lactose. For the next forty-five minutes (one hour after inflation) both sugars decrease in amount; the fall in the glucose being twice as great as that of the lactose.

A small sample of urine was obtained just before inflation. This showed the presence of reducing sugar, but we were unable to determine if both sugars were represented. Since lactose is regarded as a foreign substance in the blood, it is undoubtedly eliminated in the urine. The excess of glucose in the blood may be utilised by the tissues, assisting in the recovery of the normal balance, or it may be passed into the urine. It is unfortunate that a later sample of the urine was not secured.

Case No. 7, January 13th, 1927, gave an opportunity to verify the results of the previous fermentation tests. The principal point of interest is that the rise in sugar, after inflation, was due to glucose. The lactose absorption was slow and did not show in the tests until one hour after treatment.* In Case 6 it began within ten minutes. After the first inflation Case 7 did not progress very satisfactorily, and another inflation was administered after the blood samples had been taken, about an hour and a half after the first treatment.

There is still much to be considered in the survey of the physiological background relative to a defective carbohydrate metabolism, for this may be an important factor in bringing about the condition of acidosis or alkalosis in the body. The blood has two sources of supply for the sugar it contains: the exogenous source, which is principally the carbohydrate material of the food, and this in turn is used in the body as sugar and in the stored form as glycogen and as fat, Fig. 4; the endogenous source is from material within the body, such as glycogen, body protein and possibly, under special conditions, the fat, Fig. 5. All of the exogenous source is not available for sugar. The work of Jordan and Jentner has shown that in the cow a very considerable proportion of the carbohydrate is utilised for the production of both body fat and butter fat

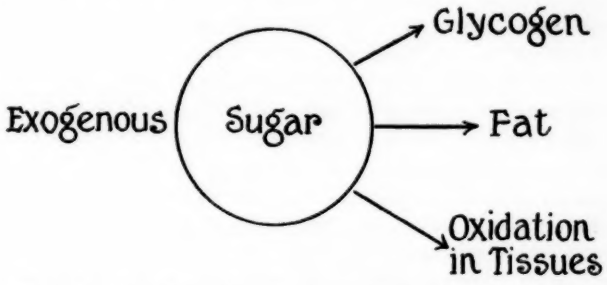

Fig. 4.—A schematic diagram illustrating how the sugar from the food may be disposed of in the body.

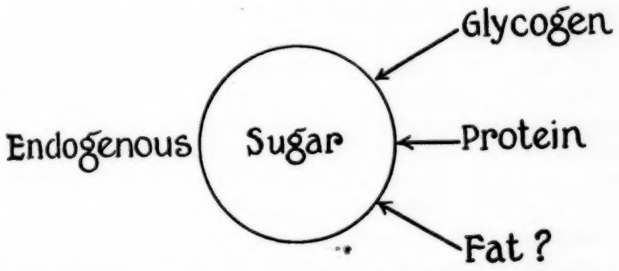

Fig. 5.—A schematic diagram indicating how the blood may obtain its sugar when outside sources are not available.

In sickness, one of the first apparent symptoms is loss of appetite and retardation or cessation of the digestive processes. The exogenous source of sugar is thus diminished or checked; the supply must then be mostly or entirely of endogenous origin, for the standard of the blood must be kept up. Even in starvation the blood sugar is well maintained for a long period.

Among the effects of a defective carbohydrate metabolism is a drain on the liver of its glycogen reserve, interfering, to a greater or less extent, with the balance of this important organ.

The glycogen reserve of the muscles may also diminish or disappear. Dudley and Marrian, experimenting with

* Probably due to incomplete inflation of the udder.

insulin on rabbits, give the following comparison of normal and insulin rabbits relative to glycogen:

	Glycogen per cent.	
	Normal rabbit.	Insulin rabbit.
Liver	5·53	1·86
Muscle	0·57	0·00

Although the normal percentage of the glycogen in muscle is much less than that of the liver, the absolute amount of glycogen in the muscles exceeds that of the liver because the total mass of the muscular tissue of the body is greatly in excess of that of the latter organ. The liver glycogen may therefore represent less than half of the total glycogen in the body. A diminished supply of sugar to the muscles, or if the muscles cannot utilise it, affects them profoundly, for sugar is their most important food so far as heat and energy are concerned. There is diminished oxidation, therefore less heat is produced. There is, likewise, a decreased amount of CO_2 and a deficient quantity of this constituent is available to the blood. There is interference with tissue respiration and, to a certain degree, there is a resultant tissue asphyxiation. Haldane has pointed out that when the partial pressure of the carbonic acid in the blood is diminished, the dissociation of hæmoglobin is diminished in consequence of the hæmoglobin holding on more firmly to its oxygen. Dissociation of the oxyhæmoglobin is assisted by the presence of carbon dioxide. With a deficiency of CO_2 there is also brought about a deficiency in oxygen.

The blood is the master tissue in that it controls the nourishment and respiration of the other tissues. It may be visualised as a sponge-like fluid; it sops up the refuse of the cells and conveys it to the various channels of elimination; it likewise absorbs other products, as for example, the hormones of the endocrine glands, and conveys them to other tissues more or less remote, besides furnishing material for the external secretions of the body. It equalises body temperature and is the home of various enzymes. It protects the body from acid-forming or alkali-forming foods in excess, and therefore prevents acidosis and alkalosis under normal conditions. It maintains in a wonderful way its weak alkaline reaction. The blood regulates its alkalinity mainly by two methods: the regulation of formation of ammonia in the body, and by the kidneys. After the administration of acids the amount of ammonia salts eliminated in the urine increases greatly at the expense of the normal elimination of urea. The ammonia combines with the acids to neutralise them. Under normal conditions, the ammonia carried from the intestines to the liver is almost entirely converted into urea, just enough is left unconverted to regulate the reaction of the blood. The kidneys as well as the liver are constantly regulating the alkalinity of the blood with an accuracy which no means of direct physical or chemical measurements enables us to measure. A possible third method is oxidation.

Hayden and Sholl in the examination of the urine of three cases of milk fever found all three of an acid reaction. Hayden in a later report of the urine findings in twelve cases of milk fever found six samples acid and six alkaline in reaction. Of the total of fifteen urine examinations, nine were acid. He states that although acetone and diacetic acid were indicated in only one examination "this does not preclude the very evident possibility of an acidosis." In the twelve cases he gives the average content of the urea as 17·25 grams per 1000. The normal average is about 26 grams per 1000, and is therefore about 50 per cent. higher than that of the milk fever patients.

Haldane and Douglas found that after a few minutes of violent exertion, the volume of CO_2 taken up by a given volume of human arterial blood was reduced to about half. They believed the reduction was due to an excessive discharge of lactic acid into the blood. Ryffel in a similar experiment showed that the lactic acid in the blood and urine was greatly increased.

It is also known that glucose in the absence of oxygen forms lactic acid. The amount of lactic acid produced is doubtless correlated with the amount of oxygen available. A condition in which less sugar is available or if the tissues cannot use it, affects the CO_2 and oxygen concentration of the blood and with oxygen reduction the conversion of glucose into lactic acid is favoured. With the accumulation of sufficient lactic acid and probable increase of production of other acids, because of interference with metabolism, it is not difficult to see how an acidosis may result. The glucose—lactic acid formation is a reversible one, and the injection of a glucose solution with its oxygen content is possibly beneficial in contributing to the reversal of the acid to glucose or keeping further acid production in check. Lactic acid is also oxidised. About one-fifth of it undergoes this change; the other four-fifths is disposed of in some other manner.

A reduced tissue oxidation not only reduces the temperature in the tissues but, since the blood is sensitive to temperature, of the blood itself, and thus a subnormal temperature of the body results.

The blood, with its altered hydrogen ion and CO_2 concentrations coursing through the nervous system, comes in contact with the nerve elements, upsetting their balance and may contribute to the production of coma or convulsions, as the case may be. It is certain of the nerve centres, however, which, permeated with this blood, may show pronounced reactions. The respiratory centre especially may be noted in this connection. Yandell Henderson has found that undue removal of the CO_2 from the blood has most disastrous effects on the circulation, producing symptoms similar to those observed in the surgical condition known as shock. When the CO_2 is removed from the body in undue quantity, the heart and circulation gradually fail and death results. The circulation fails, apparently, from an inadequate supply of blood to the heart. The simplest explanation of the facts seems to be that the tonic contraction of the walls of the veins is dependent inversely on the presence of CO_2 in the blood. Accordingly deprivation of CO_2 leads to contraction of the veins with resulting congestion of the capillaries and a decrease in the volume of blood in active circulation, simulating a condition somewhat like that induced by a hæmorrhage. The presence of CO_2 in a certain concentration in arterial blood is apparently just as necessary to life as the presence of oxygen.

Abnormal breathing in milk fever is evidently associated with a disturbance of the respiratory centre. Haldane states that the respiratory centre is a mechanism which reacts in a very sensitive manner to slight changes in the

concentration of CO_2, and that this centre is typical of other bodily mechanisms. The vaso-motor centre, cardiac centre and temperature centre may also be mentioned in this connection.

Haldane also states that it is probably in virtue of its acidity that dissolved CO_2 (H_2CO_3 or carbonic acid) affects the respiratory centre, and that other acids will therefore have a similar effect, and will thus help CO_2 to excite the centre. He believes that the centre is more sensitive to changes in the hydrogen ion concentration of the blood than to changes in the CO_2 pressure.

Although much remains to be learned it is generally admitted that there is a relationship between certain of the endocrine glands and the sugar content of the blood. The effect of insulin is now well known. The adrenal, pituitary and thyroid glands, as the case may be, have an influence in increasing or decreasing the amount of the sugar. Bodansky found a reduced blood sugar content in thyroidectomised sheep, the amount being 40-50 milligrams as against 60-70 milligrams per 100 cc. of blood in normal sheep, the normal being about 50 per cent. higher than that of the operated animals.

Watanabe has shown that injections of guanidin into normal animals produce the same derangements of metabolism that occur after removal of the parathyroids. Even before tetany, the blood sugar is lowered, blood calcium is decreased and calcium excretion is increased, phosphate retention occurs and acidosis with high ammonia execretion is observed.

That the adrenal glands have an influence on sugar metabolism is well known. Subcutaneous injections of adrenalin produce a more marked hyperglycæmia than the same amount injected into a vein or muscle. Adrenalin glycosuria occurs more or less frequently. The writer has been informed that adrenalin has been used with benefit in cases of milk fever.

Although our knowledge of the endocrine system still has far to go, it must be evident that contact of these glands with an abnormal blood changes their processes and their changed activities may contribute to the general result.

We have been imbued with the idea that the heart or nervous system is chiefly concerned in regulating the circulation but Haldane points out that the metabolic activity of the body as a whole is primarily involved; that the circulation to a large extent is determined by the activity of the CO_2 processes, and that it varies to keep the gas pressure constant in various parts of the body.

There are many cases of milk fever which are complicated with other conditions such as metritis, retained afterbirth, etc., and genital diseases which may weaken the resistance or pre-dispose the animal toward the onset of the disease. It is not a single or simple condition, but a whole litter of conditions which, in certain cases, may contribute to the changed metabolism of the body. The simplest part of the disease is the cure, and because of its simplicity we are likely to become indifferent to the complexities which enter into the cause.

Menig, in an article on Auto-Intoxication in Advanced Pregnancy, stresses three factors: mineral losses, acidosis and low blood pressure. Acidosis is associated with demineralisation and the low blood pressure is due to the diversion of about one-eighth of the body's blood to the functioning udder and a loss of tone of the heart and vaso-constrictor muscles resulting from the effects of demineralisation. By the application of hinge-like clamps to the renal arteries and restricting the blood supply to these organs, he reproduced in a cow on the seventh and eighth days after the operation appearances corresponding to parturient collapse. The clamps were removed, the udder inflated and the rectum irrigated with warm sodium chloride solution and the animal was able to stand after five hours, after having been in deep coma. In the course of fifteen years, he performed similar operations on eleven different bovines. In five aged cows and one aged bull he reproduced the symptoms of parturient collapse. Three calves, a heifer and steer did not show the typical manifestations of parturient collapse but showed evidence of auto-intoxication. One of the calves in coma was cured by the intravenous injection of saline solution.

In nine different cases of parturient collapse he applied clamps to the mammary arteries in such a way as to completely shut off the blood supply to the udder and the results were as satisfactory as udder inflation.

It is obvious that the operation on the mammary arteries would not only cause a rise in the blood pressure of the general circulation, but would also prevent further loss of sugar to the mammary gland and thus cause an increase in amount in the systemic blood in much the same way as in udder inflation. As stated by him, these operations are not of practical value in the treatment of cases; but they are of interest from a scientific and experimental point of view.

Fisher, writing on the Insulin-Glucose Treatment of Shock, states that an inadequate supply of oxygen causes partial asphyxia, and the development of acid substances in the tissues. Acidosis may be present in shock. The difference in the processes between shock and the normal condition is one of intensity. Oxidation is checked or in abeyance and the result is exhaustion. He recommends the use of 10-15 per cent. glucose intravenously and insulin hypodermically in divided doses; the first, 15 minutes after the glucose injection has been begun and the other dose at the end of the injection. Glucose alone he did not find so satisfactory or quick enough. The insulin causes a rapid oxidation of the glucose; the cells emerge from acidosis and internal asphyxia and the heat energy of the cells is restored quickly.

The picture of milk fever is not unlike that of shock in so far as it pertains to exhaustion. Defective oxidation

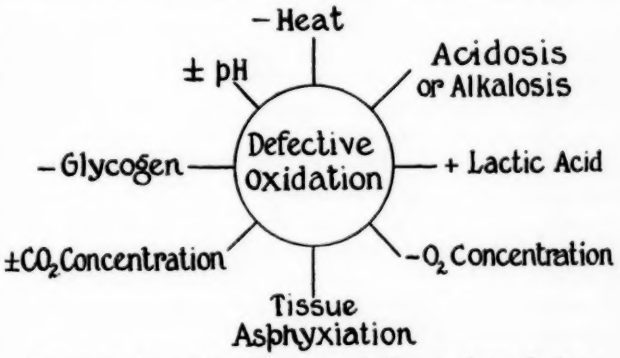

Fig. 6.—Schematic diagram of the various factors associated with defective oxidation which may be concerned with the symptoms of milk fever.

causes diminished CO_2 and oxygen pressure in the blood. There is also less heat produced because of the deficient oxidation and a subnormal temperature results. With the tissues partially asphyxiated they become weakened or paralysed and the animal is unable to support itself and goes down. The defective CO_2 and oxygen pressure of the blood affects the nerve centres, particularly the vaso-motor and respiratory centres, lowering the blood pressure and affecting the breathing more or less abnormally. The increased production of acid substances favours acidosis. Certain of these features may predominate over others and may vary in specific cases, but it is their combination that works the havoc.

Pregnancy is not pathological, but it does involve a drain on the resources of the mother to develop a new individual and supply it with nourishment during the period of gestation. Nature is willing to sacrifice the mother for the new being and its food supply—the milk. A calcium deficiency has been demonstrated during this period and during lactation, which the mineral content of the ration apparently cannot satisfy. A dietary deficiency of the mother involves a demand upon her own tissues to supply the deficiency. In this way the parathyroid glands may be involved relative to calcium metabolism.* Their disfunction not only affects calcium metabolism, but may induce a certain amount of guanidin poisoning which, according to Watanabe, reduces the amount of sugar in the blood. This possibility adds another factor for consideration and makes the matter still more complicated.

The tissues represent the centre from which the changed conditions emanate. It matters little whether there is a hyperglycæmia, if the condition of the tissues is such that they are unable to utilise the sugar brought to them ; or whether there is a hypoglycæmia where there is an insufficient supply of sugar. The result may be much the same in either case. There is lessened oxidation and there is a series of changes set up which produce the effect. The condition of the tissues relative to a hyperglycæmia may be analogous to that of a shipwrecked sailor dying of thirst although there is water all about him ; in that of a hypoglycæmia, to a traveller lost in the desert with no water in sight. In either case the effects of thirst may be fatal.

Summary.

The physiological phenomena associated with milk fever seem to point to the tissues as the centre from which the complicated train of symptoms emerges. There is apparently defective oxidation which affects the oxygen, carbon dioxide and hydrogen ion concentration of the blood. The changed character of the blood affects the whole body including the endocrine system, and as a result there is a subnormal temperature, lower blood pressure, acidosis or alkalosis, more or less tissue asphyxiation, and exhaustion ending in coma or more rarely convulsions.

The cause of the defective oxidation remains to be determined. A hypoglycæmic condition would explain much. Without a sufficiency of the material for oxidation (glucose), the process could not proceed satisfactorily. Assuming that the cause of the hypoglycæmia is the sudden and large demand for the glucose in the blood by the mammary gland for the production of lactose in the milk, it does not explain those cases of milk fever which occur before calving and before lactation has begun : nor are all heavy milkers afflicted with the disease.

The tests made in our laboratory do not show a reduction of the blood sugar below the danger line. Some of the cases cited by Widmark and Carlens showed a marked hyperglycæmia before treatment was applied. The supposition that a hyperglycæmia before treatment is due principally to the presence of a considerable amount of lactose in the blood is not confirmed by the fermentation tests. These tests (two cases) revealed only a trace of reducing substance in the blood, after fermentation, which may represent a trace of lactose, or more probably the reducing substance existing in the blood normally, in the samples of blood taken before treatment. After inflation the increased amount of sugar in the blood is due to a rise in the glucose content and to the absorption of lactose from the milk, so that a combined glycæmia and lactosemia exists. In one case the absorption of lactose began promptly (within ten minutes), and in considerable amount. The hyperglycæmia following was due principally to the absorption of lactose.* In the other case the post-inflation hyperglycæmia was not great. There was no evidence of lactose absorption until after thirty minutes after inflation. At the end of sixty minutes the blood test showed the presence of only nine mg. of lactose per hundred. The second case did not progress satisfactorily after the first inflation and a second was administered shortly after the blood samples had been taken.

If the curative effect of inflation is due to the hyperglycæmia it induces, it would appear to be to the moderate rise in the amount of the glucose over the pre-inflation glucose, or to the absorption of the lactose from the mammary gland. It is not generally believed that lactose can serve as a substitute for glucose. The blood regards the lactose as a foreign substance and eliminates it in the urine.

The injection of a solution of glucose is the logical remedy if the condition of milk fever is due to a hypoglycæmia ; but if there is already a normal or an increased amount of glucose in the blood as our cases indicate, the injection of more glucose would seemingly add more fuel to the flames. Although the tissues may be malfunctioning and may not be able to utilise the glucose available to them, it is also conceivable that in those cases of milk fever in which there is a hyperglycæmia a condition has arisen in which the increased amount of glucose in the blood is present as a defence against the causative agent and the injection of glucose solutions would then be just as logical if, by adding reinforcements, they turned the tide of battle in favour of the cure of the patient.

Conclusion.

A variation in the sugar content of the blood, either above or below normal, has not been satisfactorily demonstrated as the causative factor ; it is more likely a secondary factor resulting from an interference with the processes of oxidation in the tissues. The factor responsible for the changed tissue conditions is still to be determined.

* Little & Wright find a reduction of from 20% to 60% of the calcium content of the blood in cases of milk fever.

* Additional cases of milk fever examined since this paper was written confirm this statement.

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The Administration of the Tuberculosis Order of 1925 from the Public Health Point of View.*

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Two full years have passed since the Tuberculosis Order of 1925 came into operation. It superseded the Tuberculosis Order of 1914, which it re-enacted with the addition of certain noteworthy amendments, and the issue of the Tuberculosis Order of 1925 (No. 2) had the effect of adding article 5 (a) to the main order—an article designed to ensure that the carcases of animals slaughtered under the Order should not be disposed of in whole or in part for human consumption except with the permission in writing of the Medical Officer of Health or other competent officer of the local authority having under the Acts relating to public health or any local Act, power to inspect and examine meat intended for human consumption.

Although I cannot estimate it, I suppose it is likely that this safeguard does serve a useful purpose in some districts, albeit we seemed to get on very well without it in 1913-14, when the security against the disposal for human consumption of diseased meat from the carcases of animals slaughtered under the Order was precisely that for the carcases of animals slaughtered for traders and private individuals.

The passing of the Tuberculosis Order of 1925 (No. 2) might be deemed a little suggestive of previous laxity, and in the areas of such local authorities as the County of

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Lanark, where, with few exceptions, all food animals are slaughtered in public abattoirs equipped with resident or attending qualified meat inspectors, it seems redundant. Moreover, it causes a definite amount of delay in the slaughter of dangerous cows, increases visits and mileage, and thereby adds considerably to the cost of operating the Order without any gain from the public health point of view. To admit its necessity in any district, therefore, was *ipso facto* to grant that the pre-existing provisions for the regular routine inspection of meat were inadequate and defective.

It is apparent to all, but especially to those who are daily engaged in working the Tuberculosis Order, that it is a double-edged instrument, potent, within limits, alike in its capacity to diminish the spread and incidence of bovine tuberculosis—the veterinary aspect—and to lessen the amount of tuberculous milk that reaches the consumer—the medical or public health aspect. This duality of purpose puts the seal of importance on the eliminating work done under the order, whatever one may think of its limitations.

It is unnecessary to-day to restate how conclusively it has been proved that the consumption of milk containing live tubercle bacilli produces more or less dire results in susceptible individuals and especially in children. It is computed that upwards of ten thousand children die each year in Great Britain from tuberculosis of bovine origin, and it would be difficult to put even an approximate figure on the larger number that are marked or maimed permanently by the lesions set up by tubercle bacilli contained in milk. A recent instance has come to my knowledge, and helps to steady opinion. Over a year ago I dealt with a case of tuberculosis of the udder in a Lanarkshire town, the subject being a cow in full flow and two months calved. During the past three months or more several children whose supplies had been got from this small dairy have been under treatment for tuberculosis of the cervical glands.

It was not to be expected that an order purposely limited in its scope lest milk supplies should be unduly curtailed could operate radically to control bovine tuberculosis and protect milk consumers, and, if it can be said after two years' experience that it has not quite fulfilled the very moderate expectations of its designers, the fault lies in great measure at the door of those who have failed to implement their obligations under a legal statute.

Nevertheless, in giving power to slaughter and compensate for

(a) every cow suffering from tuberculosis of the udder or giving tuberculous milk ; and

(b) every bovine animal suffering from tuberculous emaciation or suffering from a chronic cough and showing definite clinical signs of tuberculosis,

the Order can surely be regarded as possessing strong potentialities for staying the active spread of the disease and eliminating highly dangerous milk from the market, because the designated cases embrace the chief forms of the disease in which we find the victims freely excreting tubercle bacilli.

It is peculiarly true that criticism as to the futility of the Order has come from individuals who, despite their authoritative position, have remained tolerant of slipshod methods and failed to convince their local authorities of the need for giving full effect to the articles of the Order, or to get on with the veterinary inspection of herds and thus secure the earlier detection of amenable cases.

The Tuberculosis Order can only produce its intended effect and the highest results in districts where it is operated loyally by all concerned, but, despite the passing of two years, it is singularly true that apathy exists in many places where little if any attempt is being made to carry on the good work. Local authorities are the outstanding defaulters. Many of them have failed to make suitable provision for the operation of the order, and cases reported by conscientious owners do not in many instances get proper attention, while in some districts it is averred that the part-time inspectors are definitely instructed to limit their inspection to the animal reported in order to keep down the cost of veterinary inspection. It need hardly be said that any instruction which causes a veterinary inspector to disregard the other animals in a herd to which he is called to a suspected case brings the order into ridicule, and should be deemed incompetent because it is contrary to article 4 (1), which says :—

"The Local Authority shall in every case where, by reason of information received under the preceding articles or otherwise, there is reasonable grounds for supposing that on any premises in their district there is a cow which is suffering from chronic disease of the udder or giving tuberculous milk, or a bovine animal which is suffering from tuberculous emaciation or suffering from a chronic cough and showing definite clinical signs of tuberculosis, direct a Veterinary Inspector with all practicable speed to examine the diseased or suspected animal and *any other bovine animals on such premises which the Veterinary Inspector considers it is desirable to examine* to ascertain whether any cow on the premises is suffering from tuberculosis of the udder or giving tuberculous milk, or whether any bovine animal thereon is suffering from tuberculous emaciation or suffering from a chronic cough and showing definite clinical signs of tuberculosis, and the Inspector may, with the previous consent in writing of the owner of the animal or his agent, but not otherwise, apply the tuberculin test to any cow which the Inspector suspects of suffering from tuberculosis of the udder, or of giving tuberculous milk, or to any bovine animal which the Inspector suspects of suffering from tuberculous emaciation."

Compliance with this article very often reveals other amenable cases, and repeatedly in my district we have impugned as many as three animals on a first visit.

It is iniquitous that a veterinary inspector, having found a reported animal to be suffering from advanced tuberculosis, should, for any reason, be made to deal only with that animal and neglect the examination of its neighbours that have so obviously been exposed to infection.

Surely the time has now arrived when the order should be in complete operation throughout the land and recalcitrant authorities brought to book and made to realise that in so far as they fail in their duty they vitally prejudice the value of what ought to be a simultaneous campaign. Loyal local

authorities are entitled and should now combine to request the Ministry to issue a statement setting forth the position in regard to every local authority in the country—indeed, such a resolution might competently go from this Conference. There can be no reasonable doubt that the complete eradication of tuberculosis from our herds is a possible and practicable issue which could be carried out by the veterinary profession, but it is thought by most people meantime that the work would incidentally involve an insupportable interference with our milk supplies. There are, however, some earnest thinkers in the veterinary profession and elsewhere who contend that no measures are justifiable that fall short of the earliest possible elimination of all animals proved to be tuberculous to any degree by the use of tuberculin. They believe that we could for the necessary period very well support the loss of all the potentially infected milk produced by such animals as were indicted by the tuberculin tests, and that despite such experience of shortage the later public demand for supplies guaranteed free from all tuberculous infection would be great beyond belief.

The strength and the weaknesses of such a proposal are at once apparent to all who have considered the subject. The problem obviously revolves around the question as to which would prove the greater calamity or the greater boon to those for whom we believe milk to be an essential article of diet, viz., adequate supplies of which a percentage is infective at moderate cost, or shortened supplies for a time of tubercle-free milk at enhanced prices which would gradually fall as the quantity available increased. The sudden application of the eradication plan would provide a rude shock to the dairy industry, and it would not be easy to estimate the difficulty of rehabilitating milk to its former position in our dietary when the people had in some measure learned to do without it.

But if the Tuberculosis Order were in complete and active operation throughout the land for a few years it would be competent to hope that its effect, together with the gradual increase of tubercle-free graded herds under the Milk (Special Designations) Orders of 1923, would be to confer a new complexion on the situation and eventually enable a drastic extension of the order having for its goal the ultimate eradication of tuberculosis from our herds.

If, then, we are to attain this end by easy stages, perhaps the next amplification of the order should be the prohibition of the keeping for dairy purposes of all cows over ten years of age unless thay are certified to be tubercle-free. The age limit could thereafter be gradually reduced as and when the exigencies of the milk situation permitted it. This would progressively and increasingly ensure the rearing of young stock on milk supplies becoming more and more devoid of tuberculous infection, since the producing animals by their greater youth would be less likely to be affected with tuberculosis of the udder or other open forms of the disease.

The active spread of tuberculosis lies chiefly at the door of aged animals (though culprits are occasionally found among young stock), and it is difficult to understand the mentality of owners who are wont to maintain, in contact with young bovines, very aged cows whose condition of body and coughing propensities are self-condemnatory. Repeatedly I have known infected herds which, having become self-supporting, emerged tubercle-free after a period of several years by the simple expedient, often innocent of design against tuberculosis on the part of the owner, of contriving an important part of income from the sale of all cows at the height of their value and when due to calve for the second or third time, instead of relying on the fuller supplies of milk to be ob tained by keeping these older animals in the herd.

This procedure inevitably imposed the use of milk, from young cows only, in the rearing of calves, and a gradually decreasing exposure to infection through milk or cohabitation. To get completely successful results the herd must be self-supporting, and, if it be necessary to bring in a strange animal, it should be tubercle-free in the highest sense, viz., able to stand the tuberculin tests, and guaranteed not to have been exposed to infection. I am satisfied that in all self-supporting herds tuberculosis could be successfully tackled along such lines.

The powers that be in Great Britain may entertain other ideas than the killing-out of aged cows as the next step to be taken, but I have long thought that in a breeding country, *e.g.*, like Ireland, producing dairy supplies in excess of its requirements, and where it would create no milk shortage, this plan, under proper control, would enable the speedy and economical eradication of tuberculosis from the greater part of that country.

But what of Great Britain, and what has the milk situation been during the past year? Over production has prevailed, surplus milk has been the general complaint, and the mercies have been spoiled to a considerable degree notwithstanding that the output of most dairies has been much short of their capacity, because it was considered uneconomical to produce surplus milk at about half-price by maintaining the usual expensive winter rationing. It is, therefore obvious that until a reassured public increases its demand for milk we could sustain a material reduction of our dairy cows, and it would seem the time is opportune for the killing-out under compensation of all cows over ten years of age that are not certified to be tubercle-free.

It may be urged that in counties such as Lanarkshire, where we are doing our very best under the order, and where the list of animals dealt with is considerably augmented by cases detected under the systematic yearly inspection of all herds under the Milk and Dairies (Scotland) Act of 1914, the effect of our work should already be marked by an obvious decrease in the number of cases found amenable to the order. That is neither our experience nor expectation yet awhile, for it is inevitable that we must reap for some time to come the developing crop so plentifully sown in past years, and we must, in forming a judgment, have regard to the methods of development in tuberculosis which is so often slowly progressive and remember that affected animals may maintain the appearance of health for many years though liable to break down at any time under stress of circumstances.

It has been said that a tuberculous woman may bear one child with impunity, a second with difficulty, and a third not at all or to the imminent danger of her life, and the experience of the veterinary surgeon shows that

the same germ of truth applies to many tuberculous cows. Rapidly advancing cases are commonly met with very shortly after parturition, and the loss is a serious matter. The calving period is a peculiarly trying time for the cow that is harbouring marked lesions of the disease. It would seem as if the trials of labour and the abrupt change in the relationship of organs to each other and to the parietes following the sudden emptying of the womb at calving time, combined with nervous exhaustion, operated to cause stretching or tearing of pathological adhesions gradually set up in the earlier days and readily supported during pregnancy, with the result that old centres become reactivated and set in train the characteristic diffusion of active bacilli throughout the entire system. If, therefore, we persistently remove the gross sowers of infection, it is permissible to believe the incidence of amenable cases will gradually decrease. Extensive evidence of inactivated lesions is not uncommonly found in prime fat and young bullocks.

The final extension of the Order would entail the scheduling of every form of the disease, occult or otherwise, and would involve the wholesale use of tuberculin and the immediate slaughter of all reactors. This utopian goal cannot be set up meantime, and the duty at hand is to accomplish such a marked reduction in the incidence of cases that on some future day it will be practicable to enact such a work of complete eradication as is being carried out in America, either district by district, or, if the situation permitted, simultaneously all over the country under efficient State aid.

From the public health aspect, the merit of the Tuberculosis Order centres round the power it gives to slaughter at once under compensation the cow that is yielding tuberculous milk. In other days, though her milk was banned where the optional powers of the "Dairies, Cowsheds and Milkshops Order" were taken advantage of, we had no power to put her down, nor could our interest in her extend to the control of her disposal except by persuasion, which, it is admitted, was in most cases effective. The optional powers of that Order, however, were but little taken advantage of, whereas to-day the Tuberculosis Order is, or should be, operative by obligation, and the veterinary inspection of herds under the Milk and Dairies Act has been begun in many counties.

I cannot stress too much the invaluable comradeship of the powers we possess under the Tuberculosis Order and the Milk and Dairies Act. Routine inspection of all herds is not done under the Tuberculosis Order, but that required of the Veterinary Inspector under the Act is the prime means for the early detection of cases to be dealt with under the Order. When this is well done the possibilities of the Tuberculosis Order are greatly enhanced, but the degree of well-doing varies greatly throughout the country.

Reviewing some of the articles of the order, we find certain points of interest from the public health point of view:—

Article 2.

"(1) Every person having in his possession or under his charge

"(i) any cow which is, or appears to be, suffering from tuberculosis of the udder, indurated udder or other chronic disease of the udder, or,

"(ii) Any bovine animal which is, or appears to be, suffering from tuberculous emaciation, or,

"(iii) Any bovine animal which is suffering from a chronic cough and showing definite clinical signs of tuberculosis,

shall without avoidable delay give information of the fact to a constable of the police force for the area wherein the animal is, or to an inspector of the Local Authority, and the constable or Inspector shall forthwith transmit the information to the Local Authority.

"(2) The person in possession or having charge of the animal shall forthwith take such steps as are necessary to secure compliance with article 10 (Precautions to be Adopted with Respect to Milk, etc.) and article 11 (Detention and Isolation of Suspected Animals), of this Order."

It is still too often the case that the reporting owner fails to comply with the restriction articles 10 and 11 until we have visited and served the forms, and thereafter we have in great measure to be content to trust him. His failure to isolate the reported animal is often the cause of much loss of time to the veterinary inspector. Many owners have not even yet taken the order seriously, and the very best of them are reluctant to report the cow that is yielding profitably, although her amenability on some score is markedly apparent. We have tried to improve matters by instituting prosecutions in selected cases, and can truly say that the "not proven" as well as the "found guilty" cases have served a useful purpose.

The efficiency of the Order is considerably dependent on the stockowner's observance of article 2, because, at the best, very few herds in county districts are inspected more than once per annum under the Milk and Dairies Act by the veterinary inspector, and only a fraction of them in the summer season.

In my experience the veterinary inspection of herds adds considerably to the volume of cases dealt with under the Order, and if it could be doubled or trebled many aditional cases for the order would be detected for earlier disposal, and we would be less dependent on the owner's report. Financial considerations will at all times temper the zeal of those who would fain have all milch cows inspected several times per annum instead of once only.

Like other forms of the disease, tuberculosis of the udder, though often of slow development, begins quickly and proceeds apace in many cases, and as indicating the clamant need for frequent inspections the veterinary inspectors of some city authorities who examine all cows in their area every month will frankly tell you that cows regarded as normal at their last visit will occasionally be found with a well-marked tuberculous induration of a quarter of the udder when seen one month later. My own experience bears that out, and it would be difficult for any one who fears and respects the potency of tuberculous milk to put any limit to the number of times dairy cows should be inspected each year.

Though some veterinary surgeons pay serious regard to their responsibilities under the Order, the small number of cases reported by some busy veterinary surgeons,

despite their obligations under article 3 (1) and the fee that is payable for each report, is a little remarkable. One can understand and have some sympathy with their reluctance to report the notifiable case of a demurring client, but it should always be possible to convince a sensible owner that he can only add to his loss by maintaining in his herd any case obviously amenable to the Order.

The following table shows the number of positive and negative cases dealt with by us in Lanarkshire, and indicates to what extent they were reported by owners and veterinary surgeons, or detected by us when inspecting dairy herds, during a period of twenty-three months from 1st September, 1925 :—

	Reported by owner.		Reported by V.S.		Detected by us.		Totals.	
	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.
Tuberculosis of the udder	36	167	20	21	87	156	143	344
Giving tuberculosis milk–	—	—	—	—	3	—	3	—
Tuberculosis emaciation –	93	98	37	33	25	4	155	135
Chronic cough, &c. –	133	41	72	14	59	8	264	63
Totals – –	262	306	129	68	174	168	565	542

It is noteworthy and complimentary to reporting veterinary surgeons that two out of every three cases sent in by them proved positive.

In conducting certain prosecutions under the order for breach of article 2, I have heard lawyers plead successfully against the inferred presumption that an owner could diagnose tuberculosis of the udder, or know that an emaciated cow owed her condition to tuberculosis, or that a coughing cow exhibited definite clinical signs of tuberculosis. This experience leads me to suggest that the designated cases reportable by owners might be simplified to the following terms and include :—

(i) any cow which is, or appears to be, suffering from indurated udder or other chronic disease of the udder, or,

(ii) any bovine animal which is, or appears to be, suffering from emaciation, or,

(iii) any bovine animal which is, or apppears to be, suffering from chronic cough.

The owner's excuse in the byre is " How am I to know tuberculosis of the udder, tuberculous emaciation, or definite clinical signs of tuberculosis ? " while, as I have said, his lawyer's plea in Court is that it is unreasonable to expect an owner to diagnose these conditions and so determine to report them. I cannot easily make adequate reply to these excuses for failure to report cases that at once appeal to the veterinary inspector, and I believe that a simplified category would help enormously to force the owner's hand and bring cases in at an earlier date. The *post-mortem* results illustrate too vividly that many cases which should have been dealt with earlier under " chronic cough, etc.," and while still carrying some condition of body, have been left unreported until " emaciation " was well marked and the disease on *post-mortem* examination found to be " advanced."

The description of reportable cases as it stands is quite in order for the notifications required by veterinary surgeons under article 3.

While conducting the examination of animals under article 4 (3), requiring that—

" The occupier of the premises and the persons in his employment shall render such reasonable assistance to the Inspector as may be required for all or any of the purposes of this article, and any person refusing such assistance shall be deemed guilty of an offence against the Act of 1894."

I have never found reasonable requirements to be met with resistance amounting to an offence under the Act of 1894.

Reported cases are to be examined with all practicable speed, but in times of stress most instant attention should be given to udder cases and those giving tuberculous milk because of their greater importance and bearing on public health.

In Lanarkshire it is not our habit to take mixed samples of bulk milk for the detection of tubercle bacilli, and the majority of our inspections of cows on the score of "yielding tuberculous milk " are the result of reports from, and are conducted in company with, the veterinary inspector of some city authority who periodically tests on arrival the produce of our herds daily consigned to his area.

In most of such cases it has been possible to find the culprit at once, though there are marked exceptions, and the laboratory tests of both authorities are usually in agreement. I have, however, met with exceptions both ways, the biological test being positive in one and negative in the other laboratory.

This indicates that not every sample of milk taken from a tuberculous udder contains tubercle bacilli ; indeed, I have known one-half of the initial sample to be positive and the other half negative biologically, and it is my experience that one positive result is to be relied on more than several negative ones.

On more than one occasion I have encountered the problem of " our power to deal with a cow under the Tuberculosis Order for yielding tuberculous milk whose produce has proved positive in the city and negative in the county laboratory." In such cases I believe we have no statutory authority to slaughter and compensate for such an animal, but I have invariably maintained restrictions under articles 10 and 11 of the Order until the owner signified his willingness to put her down at his own risk.

The taking of milk samples for the detection of tubercle bacilli in their milk supplies by a consuming authority is commendable work, serving occasionally to indict a herd that may not have been recently examined by the inspector of the producing authority, and, as I have shown, frequently enables the detection of an unreported case of udder tuberculosis, but on occasion no clinical case is found and so it is established that tuberculous cows may excrete tubercle bacilli in their milk in the absence of any clinical evidence of udder tuberculosis. Whether it is possible for a tuberculous cow to excrete tubercle bacilli in her milk without her udder being the seat of some microscopic tuberculous lesion is another matter.

It is unfortunate that the necessary procedure for the detection of the culprit or culprits involves the loss of much time in experimenting with group and eventually individual samples, and I suppose most people would regard it as impracticable to ban the produce of a herd whose inspection revealed no case of suspected tuberculosis of the udder, or in such a case to take, as the initial step, individual samples from every cow. This would enormously increase laboratory work and the sacrifice of guinea-pigs. But it is perhaps worth considering whether in such a case the tuberculin test should not be applied to the whole

herd, and individual samples thereafter taken from all reactors. The time may not be ripe for such advanced procedure, and I can envisage many objections that would be put forward; but, if we are honest in our views as to the dangers of tuberculous milk, the propriety of taking this further step as a speedier means of eliminating the risk is well worthy of debate.

Since the application of the tuberculin test as an aid to diagnosis permissible in certain cases under the order is a matter of veterinary interest only, I will refrain from consideration of its interesting and controversial features, excepting to say that in the case of an indurated udder a positive reaction to the test is no proof that the induration is tuberculous, and such a conclusion is only permissible when a microscopical examination or biological test of the produce of the suspected quarter has shown it to contain tubercle bacilli.

I am constrained and willing to admit the very occasional entrance of vagaries in diagnosis which practically amount to errors in regard to an odd udder case reported or otherwise suspected in which the biological experiment has given unexpected positive results, and having slaughtered the cow we find no naked eye evidence of tuberculosis in the carcase nor bacteriological or histological signs of a tuberculous process on a laboratory examination of the udder tissue. Such cases are disconcerting, but they do good by enabling a confession of human weakness creeping in at some stage, and by compensating at the highest rate we justify the trust we carry as responsible officials. It would be easy to suggest that samples must have been confused in the veterinary department or in the laboratory, or that some fault in technique has crept in, but the very occasional occurrence of such a case effectively serves to emphasise the need for unremitting care in the handling of samples taken.

Under *Article* 5 (*Slaughter of Diseased Animals*) and *Article* 6 (*Restriction of Movement of Animals Liable to Slaughter*), we have never encountered any difficulty in Lanarkshire. Owners are encouraged to go to the abattoirs and see the evidence of disease in the carcases of their animals, so that they may better appreciate the havoc caused by tuberculosis and take steps accordingly. To many of little experience the disclosure is a revelation which begets good resolutions.

All our cases are slaughtered at certain convenient public abattoirs, and if the owner desires to remove his animal to the stipulated abattoir he is paid a suitable fee, otherwise we send a vehicle from one of our panel of float-hirers. At the beginning of each year we appeal to butchers to tender for the flesh and bone of carcases or parts thereof passed for consumption by the Public Health Authorities at the various abattoirs, and the condemned carcases are lifted and paid for by the knacker, the hides being all collected by a merchant who accounts for them individually and pays the market price prevailing. Happily in Lanarkshire we are well placed to get the highest possible salvage from all our carcases.

Under *Article* 7 (*Valuation for Compensation*), we have never in any case in the past two years or under the Orders of 1913-14 failed to agree on a mutual valuation with the owner, and no special valuer has ever been called in. Even after fully explaining the meaning of "market value" as defined in the Order, some owners will "seek a street to find a house," and, if in the odd case of a self-seeking owner we have had to suggest the calling in of a valuer specially appointed by the local authority, this has invariably led him to be reasonable. The definition given of "market value" in the Order of 1925 leaves no dubiety, but when we interpreted it on a suitable occasion under the Order of 1914 as it is now defined we were called in question by the Board of Agriculture regarding several cases, but eventually they agreed that our view was sound, and, being perhaps influenced by others, they have very properly stated the exact meaning of the term.

The points to consider in assessing "market value" are perhaps too obvious to merit comment. They comprise chiefly age, breed, pedigree, condition of body, stage of lactation, milk yield, whether pregnant, cost price if recently purchased, bodily infirmities markedly apparent, including abnormality of udder, evidence of cough or heaving, diarrhœa, lameness, its cause and seat, etc., and the valuer must keep himself informed regarding the prevailing market values of all kinds of bovine animals. After explanations to an owner in his initial case we note our own valuation, and ask the owner to state or note his, and we endeavour to keep him right either way.

We refuse to value and slaughter for compensation under the order any animal that is obviously about to die from a cause other than tuberculosis, although we may have no reason to doubt its autopsy would reveal tuberculosis. We simply explain that the case, which has been reported perhaps for ulterior reasons, is not amenable to the order, but if the subsequent *post-mortem* examination by the owner shows some lesions of tuberculosis, his grudge is often emphatic, if not effective.

All animals put under restriction because suspected should be valued at once, if the owner is present, to save further visitation and expense after laboratory tests have been conducted, but the owner or the Inspector may reasonably require a second valuation in the case of a cow that is not condemned until after the lapse of four or five weeks.

Article 8 (*Post-Mortem Examination of Slaughtered Animals*) *and Article* 9 (*Compensation*).

The effect of these articles is to make the veterinary inspector solely responsible for the *post-mortem* examinations, and the amount of compensation payable is automatically regulated because it is based on the market value and the *post-mortem* findings, and is as follows, viz.:—

(a) If no tuberculosis is found, the whole market value, plus the sum of twenty shillings.

(b) When tuberculosis, not in an advanced state, is found, three-fourths of the market value, or the sum of forty-five shillings, whichever sum is the greater, after deducting one-half of the reasonable costs of any valuation by a valuer appointed by the Ministry.

(c) When advanced tuberculosis is revealed, one-fourth of the market value, or forty-five shillings, whichever sum is the greater, subject to the deduction of one-half of the costs of valuation as under (b).

In order to secure uniformity in *post-mortem* findings the term "advanced tuberculosis" is again clearly

defined, and has also been amplified. Tuberculosis is to be considered "advanced"—

(a) When there is miliary tuberculosis of both lungs, or,

(b) When tuberculous lesions are present on the pleura and peritoneum, or,

(c) When tuberculous lesions are present in the muscular system, or in the lymphatic glands embedded in or between the muscles, or *where the infection of lymphatic glands is sufficient to indicate that disease is widespread, or*

(d) *Where in addition to the presence of tuberculous lesions in the respiratory and digestive tracts there are also lesions present in the substance of membranes of any two of the following:—spleen, kidney, uterus, ovary, testicle, brain, and spinal cord.*

(*N.B.*—The amplification of the terms of the Order of 1914 is shown by italics).

The working of the Order is facilitated when it is possible for the veterinary inspector to make his *post-mortem* examinations in the presence of the meat inspector. If this is not possible, it is advisable that they should consult by telephone or otherwise.

Although the definitions of "advanced tuberculosis" under the Tuberculosis Order and of "generalised tuberculosis" under the Public Health Acts are almost, they are not quite, analogous, and it is difficult to understand why they are not exactly alike, for the distinction only serves to confuse students and at times engenders an apparent difference of opinion between the veterinary inspector and the meat inspector that is not very real.

Under the Tuberculosis Order "advanced tuberculosis" is defined as shown above, whereas under the Public Health Acts tuberculosis is to be regarded as "generalised" in the following cases:—

(1) Miliary tuberculosis of both lungs, with any evidence of tuberculosis elsewhere.

(2) Where lesions are multiple, acute and actively progressive.

(3) Where there is multiple and widespread infection of the carcase lymph glands.

(4) Where there are diffuse acute lesions of both serous membranes (pleura and peritoneum) and any of the carcase lymph glands are enlarged or contain visible tuberculous lesions.

(5) Where, in addition to the presence of tuberculous lesions in the respiratory and digestive tracts, there are also lesions present in the substance of any two of the following:—spleen, kidney, udder (or uterus or ovary), testicle, brain, and spinal chord or their membranes.

(6) Congenital tuberculosis in calves.

In the great majority of cases when the veterinary inspector reports "advanced" tuberculosis, the meat inspector regards the case as "generalised." The meat inspector, however, has often to condemn a carcase in which the lesions of tuberculosis found by the veterinary inspector cannot be regarded as "advanced," *e.g.*, a case of udder tuberculosis may present "not advanced" lesions of the disease and the carcase merit condemnation owing to the presence of sepsis in an important organ.

In a very few cases we have slaughtered animals and not been able to find clear evidence of tuberculosis. The full market value plus twenty shillings has been paid by us—

(a) In three cases wherein milk samples taken from reported cases proved positive in the laboratory. In each case our *post-mortem* investigation included a careful laboratory examination of the udder tissue.

(b) In two cases of pulmonary strongylosis in four-year-olds.

(c) In one case of markedly exudative bronchitis (cause undetermined).

(d) In one case of multiple pulmonary abscesses due to traumatism by a foreign body.

It is easy to trip into the non-application of the tuberculin test in the cases indicated under (b), (c), and (d), especially when the case is long way off, the animal is past adolescence, and auscultation of the chest reveals sounds suggestive of tuberculosis.

The veterinary inspector should, as far as possible, keep a record of "hoose-infected" premises, and condemn no coughing bronchitic animal under five years of age without having used tuberculin.

If in any case the sum received by the local authority on the sale of a carcase or part of it exceeds the amount due for compensation, the excess is payable to the owner after deducting reasonable expenses. This occasionally occurs if it happens that the veterinary inspector has reported "advanced" tuberculosis and the meat inspector has passed the whole or part of the carcase. It may also happen when the carcase of a cow of low market value in which the lesions have been regarded as "not advanced" passes well in the meat inspector's hands.

Article 10 (*Precautions to be Adopted with Respect to Milk etc.*), *and Article* 11 (*Detention and Isolation of Suspected Animals*).

In practice I have found it convenient to serve on the owner a notice combining the requirements of these two articles, and it is to be noted that the service of a detention notice is now obligatory, whereas under the Order of 1914 it was optional. When a restriction notice is served under these articles in respect of a suspected case of udder tuberculosis, the veterinary inspector should carefully explain the position so that the owner may not in his absence be tempted to mix the milk with other milk or fail to boil or sterilise it and the utensils that have contained it, all in terms of the notice served. Although the restriction notice may remain for six weeks to enable biological tests of the milk to be carried out, I find that the biological result is usually available in four weeks. I invariably act at once on a positive microscopic result, and have never been let down—the milk sample having been taken under proper precautions into a sterile bottle from a case of typical tuberculous induration of a quarter of the udder.

	Positive Microscopically.	Positive Biologically.
Number of milk samples	120	33

Complaints with which I have some sympathy occasionally come in when the milk of a cow in fair yield has been forbidden to be mixed with other milk for a month or so, and the result of the biological test proves negative.

If the microscopical result is negative in a highly suspicious case, I contrive to bring in repeat samples at once, and in many cases am thus able to deal with the cow long before the biological test has matured.

Article 12 (*Suspected Animals in Markets, Fairs, and Sales*).

If more animals were detected and dealt with in public markets the tendency would be towards increased reporting of cases by owners. This article empowers the veterinary inspector, by notice served on the owner or person in charge of the animal, to require it to be removed from the market, fair ground, sale yard, or other place to the premises from which it was brought thereto, or at the option of the owner or person in charge to a slaughterhouse or other suitable premises specified in the notice, and thereupon the animal must forthwith be moved by the owner or person in charge to those premises for the purpose of examination under the provisions of the order, or slaughter by the owner in the slaughterhouse.

This article is too complacent. When an owner exposes for sale an animal obviously or suspected to be suffering from one of the designated forms of tuberculosis reportable under the order, he has acted in breach of article 2 in failing to report, he has probably caused the exposure of other animals in the market to open infection, and it would be better that the case should be summarily dealt with by licensing its removal to the nearest abattoir for slaughter at the owner's risk. I have found that some such cases have been brought to our markets from places without the county, and it seems unfair to allow the animal to be licensed to premises to be examined, dealt with and compensated for by the local authority of the veterinary inspector detecting the case.

Article 13 (*Cleansing and Disinfection*).

I take advantage of the optional powers of this article in every case, and serve the notices along with the *post-mortem* report on the owner, but perhaps too little attention is given to see that the owner has carried out efficient disinfection.

Final Observations.

In any endeavour to sum up the situation in respect of the efforts to get rid of bovine tuberculosis, we must constantly keep in view and have regard to—

(a) The insidious infectious character of the disease.
(b) The enormity of the economic loss it entails in our herds every year.
(c) The widespread character of the disease.
(d) The communicability of the bovine disease to man.
(e) Its lethal effect on children and its power to cripple where it does not kill.
(f) The appalling annual cost to the ratepayer in equipping and maintaining tuberculosis hospitals and sanatoria for the treatment of those who contract the disease.
(g) The possibility, amounting to a certainty, of eradicating bovine tuberculosis to the permanent saving of our herds and the very material reduction in future of our public health expenditure.

We got rid of an almost exactly analogous disease of horses, viz., glanders, by the proper use of mallein, and we have in tuberculin its very prototype in every respect for freeing the country of bovine tuberculosis.

It is a clear issue, and under the Tuberculosis Order we have a great work to do, but its scope must be increased at the earliest possible date, because the added results to be derived from enlarged powers in prevention and execution would amply justify whatever expenditure or inconvenience they entailed.

It would perhaps be well, therefore, if some of the discussion to follow this paper centred around the additional powers that might be required under the order to make the campaign increasingly sure of attaining its ultimate goal.

May I suggest a rough summary as a basis for such discussion—

(1) That the present order as it stands be henceforth strictly enforced throughout the country for a period of from six to twelve months.
(2) That meantime the Ministry of Health be asked to give increased encouragement and financial assistance to the work of bringing in additional tubercle-free herds under the Milk (Special Designations) Order (Scotland) of 1923.

(Grants should be made to enable the proper handling and eventual slaughter under compensation of all animals discarded as reactors to tuberculin by owners holding, or about to apply for, a licence for the production of "certified" or "grade A (tuberculin-tested) milk.")

The sale, for dairy purposes, with or without declaration, and the broadcasting of such animals, is disliked by all.

(3) That if such financial assistance were forthcoming we should have power to put an identification mark on all such reactors and have them slaughtered at once, if dry, and not advanced in pregnancy, and otherwise, as soon as their lactation period was about closed.
(4) That within twelve months the Tuberculosis Order should be amplified to give power to prohibit the mating, and cause the slaughtering out, of all cows ten years old and over as soon as their milk yield fell to two gallons per day unless they were certified to have recently stood the tuberculin tests.
(5) That the age limit for cows in such infected herds be reduced after a period to nine years and later to eight years, exempting again cows that are certified to be non-reactors.
(6) That after the lapse of four years under this scheme it would be possible to begin the work of total eradication by the extensive use of tuberculin, dealing first of all with herds that are almost or completely self-supporting, and gradually closing in on others, area by area as circumstances permitted.

Sir Robert Phillip recently expressed the hope that thirty years hence human tuberculosis would be spoken of as a memory of the past. Such a consummation in respect of bovine tuberculosis would be possible in less than half that number of years.

The Veterinary Record.

7th January, 1928.

ANIMAL DIETETICS.

It is universally acknowledged that in the matter of food and feeding of the human being the medical man is the prime authority. His knowledge of human physiological function and his special training in its relation to health and sickness constitute him the expert to whom all questions of diets and dieting are referred. His authoritative position on dietary, so far as mankind is concerned, is therefore unassailable, and it may be taken that such position is approved of and supported by public opinion generally. When, however, it comes to a matter of diet and dieting of animals, we find no fixed responsibility, no definite authority. Animal dietetics is a medley of system, often directly attributable to the opportunist, and in many instances continuing to follow the rule of empiricism. It is true that in the fixing of diets and dieting of horses the veterinary surgeon is considered the authority, and in large studs of horses and in the army his opinion and advice hold first place, but in the dietetics of other animals veterinary science counts for little. For instance, the authority on the diet and dieting of cattle and sheep is left to the agriculturalist, the bio-chemist and even medical directors of animal nutrition centres ; canine dietary for the most part is in the hands of the patent dog food manufacturers, who publish brochures on canine feeding for all breeds, which are largely read and followed by dog owners.

Good grounds exist for the consideration of a more rational procedure in the study of animal dietetics, and in a centralising of authority based on the full knowledge of animal anatomy, animal physiology and animal function, and the fuller knowledge of animal health and disease in co-relation. Without these qualifications no person can be constituted an authority in animal dietetics ; authority otherwise is misplaced.

It is extremely important and necessary that the veterinary profession should carefully consider and guard this point of view, and that its rightful function or scientific status should not be usurped by persons or institutions who, by seizing opportunity and perfecting it, in the end establish a claim to dispute authority. It seems absolutely wrong that in a country maintaining veterinary colleges where the whole gamut of veterinary science is taught, a graduate in Arts from an animal nutrition centre should be sent under a Government scholarship to a non-veterinary institution for the study of animal physiology, a matter still further intensifying the loss of prestige and authority to which a true and correct veterinary science is permitted to drift.

Spasmodic endeavours of individual members—a paper here or a lecture there and recorded only in a veterinary periodical—avail little. What is required is a thorough public overhauling of the whole veterinary structure, its backbone as well as its locomotory apparatus, and a grading up of all those elements which go to make veterinary science what it ought to be with a well-defined responsibility in preserving the health as well as relieving the sickness of all animal kind.

We commend to our readers this week a well expressed article on "Bulk in Animal Feeding," from Mr. E. Alfred West. May it prove the germ to create interest in a direction which is essentially a part of the sphere of the veterinary profession.

CLINICAL AND CASE REPORTS.

Clinical Cases Discussed at Durham.*

Mr. J. R. RIDER presented the first and second phalanges from the near fore limb of a pit pony, illustrating an unusual fracture of the second phalanx, involving the inter-phalangeal joint. The injury had been caused at work underground, the circumstances being that the pony had caught the foot under a tub rail and fallen. While in this position the rope haulage began to run, and although the rope was stopped without delay, this could not be done before the pressure of the rope, as it passed over the joint, had caused serious injury. The rope was hauling full tubs, and the accident occurred on a curve in the roadway.

The superficial structures were severely lacerated, and it was impossible to diagnose fracture with certainty.

After ten days' treatment, during which the superficial injuries were healing satisfactorily, the lameness remained acute, and crepitus was detected. Destruction of the patient, followed by *post-mortem* examination, shewed that the collateral ligament had been ruptured, while further preparation revealed a groove, corresponding in shape and size to the rope, passing obliquely upwards across the inner aspect of the joint. The sesamoid bones were not affected, but the upper inner border of the second phalanx could not be found, despite careful search. The filing action of the rope had produced an unusual type of fracture.

Mr. J. W. RIDER mentioned the case of a pit pony which was returned from work with an everted rectum, and which was said to have been purged while at work. His own view was that the injury was probably the result of some trauma, since there was no subsequent diarrhœa. Treatment consisted of cold antiseptic douches and resulted in recovery in three weeks, without any sloughing.

He recalled a case, some years ago, of a yearling which, while at pasture, was found with an everted rectum. This was reduced without difficulty.

* Cases presented to the North of England Division at Durham on December 3rd, 1927.

The speaker then asked the question: Can eversion of the rectum occur in working horses without being caused by some injury?

Members were of opinion that eversion could occur under these conditions, more particularly in the smaller animals.

Mr. C. G. HILL remarked that in his view intussusception was present in 50 per cent. of the cases of eversion of the rectum in puppies.

He mentioned a recent case in a Deerhound, in which he found about nine inches of intestine protruding from the anus. Laparotomy revealed that the whole of the small intestine was invaginated, and the condition appeared to have been in existence from seven to ten days, although the history indicated that the puppy was healthy two days previous to examination. This case ended fatally.

Mr. H. PEELE quoted cases of rupture of the rectum, occurring in gelding pit ponies during the strike, following attempted coitus by stallions.

Mr. T. M. MITCHELL mentioned a case of acute cervicitis in a cow, in which there was prolapse of the os uteri, and eversion of about two feet of the rectum. There was constant straining, but under the influence of chloroform anæsthesia it was possible to reduce both the eversion and the prolapse. Later, however, the conditions recurred and the cow was slaughtered.

Mr. G. THOMPSON remarked that in cases of eversion there was frequently present some ulceration of the rectum.

SOME OBSCURE CONDITIONS IN EQUINES.

Mr. HILL presented notes on the case of a hunter mare which had been a source of trouble to him. This animal had been pastured with others during the summer, and on being brought up in September did not progress as well as could be desired. The other horses conditioned normally. The mare was first seen on 9th September, and prior to examination appeared to be normal. Closer inspection, however, shewed a sub-normal temperature and a slow weak pulse. The records of temperature and pulse during the period of observation were as follows:—

DATE.	TEMPERATURE.	PULSE.
9-9-27	97°	30
10-9-27	98°	30
11-9-27	98°	28
12-9-27	97.4°	28
13-9-27	98°	30
14-9-27	98°	30
15-9-27	97°	28
16-9-27	100°	30
17-9-27	100°	30
18-9-27	100°	30
19-9-27	Animal Destroyed.	

In the early stages the appetite was reduced, the condition becoming progressively worse, until towards the end it was entirely absent.

The mare could not be induced to swallow the stomach tube. During the 16th and 17th œdema of the hind limbs and abdomen appeared, followed on the 18th by œdema of the lips and eyelids. No petechiæ were seen on the nasal mucous membrane. At this stage heart and lung sounds were normal. The fæces remained normal in appearance.

Examination for worm ova shewed small numbers of eggs, but these were considered of little importance.

On *post-mortem* examination only one worm was found, but no other microscopic lesion could be detected in any organ.

The case had remained unsatisfactory to the end and Mr. Hill welcomed the opinions of members as to the probable condition. Several suggestions were made, but each was ruled out by Mr. Hill.

Mr. MITCHELL described a case having a similar feature in that the animal was unable to swallow.

The horse was eating normally, when he suddenly ceased, and blood issued from the mouth. The horsekeeper, who examined the mouth, thought he detected a piece of wire in the root of the tongue, but was unable to find it again. Mr. Mitchell's examination a few hours later failed to detect the foreign body. Two days later the throat region became swollen and all food was refused. Later the horse was able to feed out of a deep bucket. This method continued for a month, when the animal began to eat hay.

He attributed the condition to some injury of the hypoglossal nerve which rendered the act of deglutition impossible.

Mr. H. S. ELPHICK mentioned a similar case fed on grass, in which the ingesta returned by the nasal cavity. *Post-mortem* examination revealed normal organs, and the condition was thought to be due to paralysis of the glottis.

Mr. THOMPSON described a case of foreign body in the mouth of a cow, in which the triangular knife from a reaper blade penetrated to the exterior in the region of the *parotid duct*.

Ringworm on Human Beings: Supposed Transmission from the Cat.

BY HENRY TAYLOR, F.R.C.V.S., Haywards Heath.

Last summer, two ladies, friends, but not living in the same house, came with a kitten for my inspection, with a request that I should thoroughly examine it to see if there was anything wrong with the skin, as both of them had developed some "spots" after nursing the animal. The kitten had been recently purchased for £5 and was apparently in good health and condition, but on more minute examination it was noticed that a few lice were present. A careful inspection of the skin did not reveal the slightest loss of hair on any part of the body and there was certainly no symptom of ringworm of the cat, as described in the text books.

The "spots" on the skins of the ladies were next examined; these were circular and about the size of a sixpence, with a red outline. It appears that the two ladies had nursed the kitten and allowed it to crawl round their necks, with the result that "spots" had arisen on their arms, breasts and necks; there were none on the face or in the hair, however. Personally, I should have diagnosed the spots as ringworm, but it must be admitted that the diameter was not so large as the lesions of ringworm obtained from the cat, nor were there any pustules; and moreover the lesions did not seem to extend very deep into the skin: they seemed rather superficial. Probably each lady had about half a dozen places affected. Another

person, a young girl whom I did not see, was also reported to be similarly affected after nursing the kitten.

A dermatologist, well up in his work, gave it as his opinion that the lesions of the skin were animal ringworm of the microsporan variety.

The case is interesting because the inference is that the kitten harboured the ringworm, though showing no skin lesions itself; further, it was not the kind of ringworm which is generally supposed to affect the cat.

Follicular or Demodectic Mange of the Dog.

By H. TAYLOR, F.R.C.V.S., Haywards Heath.

As far as my experience goes and in spite of the trial of a good many remedies, treatment is still unsatisfactory. On showing a case to a medical acquaintance, a dermatologist, recently, he outlined a line of treatment which it might be worth while trying. One must remember that Mettam many years ago reported a cure simply by the injection of a vaccine made from the pustules without external applications, and so my friend suggests that as sulphur is one of the best remedies for streptococcus infections, if it could be made very penetrating and carried down into the depths of the skin, it might destroy not only the germs but also the demodex.

With this end in view, the following preparation is suggested:—

Sulphur, 3 parts; carbon tetrachloride, 27 parts; carbon bisulphide, 60 parts.

Dress once every other day. Rub in with a lump of wool in the open air.

The sulphur is soluble in the carbon bisulphide which evaporates, leaving the former in the skin.

The carbon tetrachloride is only to reduce the inflammability.

FOOT-AND-MOUTH DISEASE: THE MINISTRY'S WARNING.

The following warning was issued on Monday by the Ministry of Agriculture:—

"The Ministry of Agriculture wishes to draw the attention of agriculturists to the present serious situation with regard to foot-and-mouth disease. Since December 10th, seventy-one separate farms have become infected in the North Midlands, and inquiries to date show that diseased animals were exposed at eleven markets.

"The main factor in this widespread infection has been the neglect on the part of a number of stockowners to report the first signs of disease to the police as the law requires. There have been no fewer than twelve cases in which the lesions discovered in the affected animals have been more than four days old. In ten of these they were more than a week old. In this way the markets were infected, and infection spread before the Ministry or local authorities had any opportunity of taking measures to prevent it. Legal proceedings are, of course, pending in these cases.

"Warnings against the danger of delay in reporting have been issued from time to time, and it should not be necessary to repeat them. Stockowners generally require to take a more serious view of their responsibilities in this matter. The heavy expenditure of public funds incurred in keeping this country free, or comparatively free, from foot-and-mouth disease cannot be justified unless agriculturists themselves furnish a full measure of support by early reporting of suspicious symptoms of disease in the mouths and feet of their stock."

DIVISIONAL REPORT.

North of England Division.

ELECTION OF OFFICERS.

A meeting of the North of England Division was held in the Mayor's Chamber, Durham, on 3rd December, 1927.

The President, Mr. J. W. Rider, occupied the Chair, and the attendance book was signed by Messrs. Jarvie, Peele, Taylor, Thompson, Hill, Forbes, H. S. Elphick, T. M. Mitchell, Wilkinson, McDowall, Hicks and J. R. Rider, Hon. Secretary.

Visitor.—Mr. W. Jackson Young.

Apologies for absence were received from Messrs. Snaith, Parker, Stewart, Davidson and Professor Hobday.

The PRESIDENT intimated to the meeting that since the last meeting a sad and severe loss had fallen on one of their members, Mr. A. Scott, of Morpeth, by the death of his wife. He was sure members would wish to mark the expression of their sympathy with Mr. Scott by passing a vote of condolence, and also by instructing the Secretary to write a letter of sympathy. The meeting passed the vote of condolence, standing in silence.

Correspondence. (1) From Mr. C. Elphick, returning thanks for an expression of sympathy extended to him in his recent illness.

(2) From Mr. Sheather appealing for the support of the Division for his application for the registration of his premises under the Vivisection Act.

ELECTION OF OFFICERS.

President.—The PRESIDENT said that the duty of proposing his successor in the Chair was a particularly pleasant one, for he was going to suggest the name of Major H. Peele. (Cheers.) He felt that in Major Peele the North of England Division would be fortunate to have for its President during the most important year of its recent history, a gentleman who was keenly interested in its affairs, and who would fill the Chair with credit to himself, as well as to the great advantage of the Division.

It was unnecessary to remind members that the duties of his successor would be more onerous next year because of the visit of the "National" to Newcastle, but he knew the new President would receive unstinted support, and he wished him a very successful year of office.

The President's proposal was received with acclamation, and carried unanimously.

Major PEELE, in reply, said that he understood that the motion before the meeting was purely formal, and that the infliction of a Presidential address was usually deferred to the Annual Meeting. At this stage he could say that he felt highly honoured in being elected to the Chair for such an important year as that which lay before them. He thanked the President for the flattering remarks he had made and while looking forward to a successful year of office, would continue to hope that when his term was over he would not be found wanting.

Senior Vice-President.—In accordance with custom, the retiring President was unanimously elected to this office.

Junior Vice-President.—Mr. T. M. Mitchell was elected to this office, amidst the applause of the meeting.

Auditors.—Messrs. H. S. Elphick and H. Hicks were re-elected.

Hon. Secretary and Treasurer.—Mr. J. R. Rider was re-elected to these offices.

Council.—The retiring members offered themselves for re-election, and it was agreed that, as Major Peele would become an *ex-officio* member by virtue of his office, the retiring President should take his place on the Council. The members were, therefore, elected as follows: Messrs. Davidson, C. Elphick, Hill, J. W. Rider and Wilkinson, together with the President and Secretary *ex-officio*.

[A discussion on clinical cases followed, and this will be found in the Clinical and Case Report Section of this issue. —Ed.].

A meeting of the Inspectors' Section followed the ordinary business meeting, when the Chairman, Mr. H. PEELE took the Chair.

Mr. JACKSON YOUNG gave a brief address on the equipment with which all veterinary inspectors should be provided.

The CHAIRMAN, after thanking Mr. Young for his address, said that a further subject which might usefully be considered by the Section was the methods of procedure in the areas of neighbouring local authorities.

It was not possible to consider this subject at this meeting, but it would be useful to discuss it at a later date.

The proceedings then terminated.

J. R. RIDER,
Hon. Secretary.

R.C.V.S. OBITUARY.

STEVENSON, George, Kirkwall, Orkney. Graduated, N. Edinburgh, 16th December, 1889. Died, 8th December, 1927, aged 60 years.

GARRY, Thomas Cozens, 2 High Street, Wandsworth, S.W.18. Graduated, London, 16th May, 1890. Fellow, 10th December, 1895. Died, 23rd December, 1927, aged 65 years.

. . . . . .

"Mr. Thomas Cozens Garry, F.R.C.V.S., died on Friday at 'Seaview,' Isle of Wight. Sixty-five years of age, he was very well known in Battersea and Wandsworth, where he had practised as a veterinary surgeon for thirty years," says the *South Western Star* of 30th December. "His professional offices were at High Street, Wandsworth. Mr. Garry had been unwell for about three months. He went to the Isle of Wight some two months ago to recuperate after a severe illness at Brighton. The late Mr. Garry was formerly a partner with the late Mr. Cheeseman. When that gentleman died Mr. Garry took over the business, and on the death of Mr. Boswell, of Lavender Sweep, he bought the practice that had been carried on by that gentleman. For the last three years Mr. Thomas has been a partner with Mr. Garry.

"Deceased sold his house at 4 Spencer Park, Wandsworth, about twelve months ago. While at Wandsworth he was prominently identified with the Wesleyan Church. He leaves a widow and three daughters."

NOTES AND NEWS.

The Editor will be glad to receive items of professional interest for inclusion in these columns.

Diary of Events.

Jan. 9th—Meeting of the Derbyshire Division, at Royal Hotel, Derby.
Jan. 10th—N.V.M.A. Committee Meetings.
Jan. 11th—N.V.M.A. Council Meeting.
Jan. 11th, 12th, and 13th—R.C.V.S. Committee and Council Meetings.
Jan. 12th—Meeting of the Central Division at the Royal Veterinary College.

PRESENTATION TO DR. SHAVE.

At the close of the Examinations of the R.C.V.S. at the Royal Veterinary College, Dr. E. S. Shave was the recipient of the parchment conferred on Hon. Associates of the R.V.C.V.M.A.

Principal Hobday, as patron of the Society, made the presentation. He asked Dr. Shave to accept the honour, which was backed by the good wishes of all past and present students of the College. The Society was one of the oldest of the English veterinary societies and the honour of Hon. Associate was one which was rarely given. Dr. Shave had, in his career at the College, been associated with the Society for forty odd years and never had the honour been more worthily bestowed. (Applause.) As an old student of the College, he appreciated more than he could say his pleasure at being selected to make that presentation to his teacher. The certificate bore the date 1836 and brought to his mind the memories and traditions of the past which had been so worthily upheld by Dr. Shave. (Applause.)

Dr. SHAVE, in reply, thanked Principal Hobday for his kind words and the Society for the honour conferred upon him. He had been associated with the College and the Society for most of his life; he would treasure the certificate and hoped that he deserved it. (Applause.)

LORD BLEDISLOE'S TRIBUTE TO THE LATE PROFESSOR PENBERTHY.

The Rt. Hon. Lord Bledisloe, K.B.E. (Parliamentary Secretary, Ministry of Agriculture) speaking on the occasion of the Annual Dinner of the Farmers' Club and the Central and Associated Chambers of Agriculture, held on December 8th, 1927, paid an impressive tribute to the late Professor John Penberthy, J.P., F.R.C.V.S.

Referring with sorrow to the number of leading members of both organisations whom death had removed from their midst, Lord Bledisloe said: "They include, amongst others Professor Penberthy, than whom I have not known a more zealous protagonist in the interests of agriculture, either in the County of Gloucester, where I live, or in London, where he was pre-eminent amongst those who were not only prepared to fight the battle against animal disease, but fight the battle for fair treatment of our industry."

ARMY VETERINARY SERVICE.

LONDON GAZETTE—WAR OFFICE—REGULAR FORCES.

January 3rd.—The following promotion is made (January 1st) :—To be Bt. Lieut.-Col. :—Major E. C. Webb, O.B.E., F.R.C.V.S., R.A.V.C.

TERRITORIAL ARMY.

Major P. W. Dayer Smith, O.B.E., T.D. (Comdg. 47th (2nd Lond.) Mob. Vet. Sect.), to be Bt. Lieut.-Col. (January 1st).

Lieut.-Col. P. J. Simpson, D.S.O., T.D., F.R.C.V.S., vacates the appointment of D.A.D.V.S. of a Div. (January 1st). Major A. Robb, T.D., vacates the appointment of D.A.D.V.S. of a Div. (January 1st). Major A. C. Duncan, T.D., F.R.C.V.S. is appointed D.A.D.V.S. of a Div. (January 1st). Major J. G. McGregor is appointed D.A.D.V.S. of a Div. (January 1st).

CORRESPONDENCE.

Letters to the Editor should reach the Office not later than by the first post on Tuesday morning for insertion in following Saturday's issue.

All correspondence must bear the name and address of the contributor for publication.

The Editor does not hold himself responsible for the opinions of his correspondents.

American Veterinarians and Professor Bang.

TO THE EDITOR OF THE VETERINARY RECORD.

Sir,—The extract from an American contemporary published in your issue of December 3rd, 1927, under your heading : " America Lauds and Criticises Professor Bang," does an injustice to the veterinarians of North America in that it represents the opinion of one person only, and would no doubt be disapproved by 99 per cent. of the total. We at least feel certain that the vast majority of the veterinarians of this continent, were they to read the above-mentioned extract, would deplore this criticism of our distinguished guest and talented savant from Denmark.

All are in accord that Professor Bang's lectures before our national association were scholarly, scientifically sound, and in no sense construed as being antiquated. Certainly no one who has kept in touch with the tuberculosis control work in this country and Canada could have found a flaw in his lectures. The fact that the Bang's system of eliminating tuberculosis from herds has not been widely adopted in this country, is no reflection on its practicability or merit. On the contrary, it is venerated here as a sound idea from which many a valuable detail has been drawn, and its disuse is due to the well-known fact that no sooner had our livestock industry realised that bovine tuberculosis is a menace to face than the " accredited herd plan " came into vogue, and thus made further extension of the Bang's system unnecessary. As all the world knows, the " accredited herd plan " was superseded by a nation-wide system of eradication both in the United States and Canada. We would like these facts to be known to our British colleagues and through them to the Continental veterinarians.—Very respectfully yours, *The North American Veterinarian*, L. A. MERILLAT, Editor.

22*nd December*, 1927.

" Tuberculosis of Bovine Origin in the Human Subject."

TO THE EDITOR OF THE VETERINARY RECORD.

Sir,—A member of the veterinary profession, such as myself, who has for a number of years accumulated experiences in respect of the incidence of tuberculosis in the milk-producing animals of this country, and who has perused the reprint in your last issue of Dr. A. Stanley Griffith's lecture on this subject, finds it impossible not to express the opinion that the veterinary and medical professions should, years ago, have taken steps to cause the public and milk producers to be educated, to a far greater extent than obtains at present, upon the subject of milk-borne tuberculosis.

I do not remember ever reading a more convincingly stated accumulation of scientific *data* than this article represents, nor one in which the condemnation of the present state of things becomes so apparent, as in Dr. Griffith's lecture. He has my sincere admiration.

There is one part of the article that particularly appeals to me, and that is his reference to " the enlightened and patriotic producers " who have their herds periodically tested, and who also do their utmost to produce milk free from tuberculous and other contamination. These patriots, as I always picture them, are, in my opinion, actually producing an article which is to the benefit of the public health, and therefore they should be granted some state assistance. I do know, for a fact, that the number of producers of Grade " A " tuberculin-tested milks would be instantly increased if they were granted aid in the expense of having the test applied and a licence granted free of charge for its production and sale. It is a curious anomaly that such milks can be and are produced at a much smaller scale of costs in Scotland than in England and Wales, and for the reasons stated.

As one now employed in the execution of the Tuberculosis Order and formerly in the examination of a large number of dairy cows, it is an extraordinary fact that I find, even in an area in which the incidence of bovine tuberculosis is comparatively low, the great majority of cattle coming under the Order to be those which have already performed an enormous amount of damage before they were reported ; and comparatively, too, with the number of animals so dealt with the percentage of animals showing definite clinical evidence of tuberculosis of the udder, to be enormously high—which latter condition is rarely, if ever, found to cause the owner (milk-producer) the least worry or alarm.

If the immediate foregoing paragraph be taken as an average illustration of what is probably incidental to most other areas or counties ; if one considers the enormous numbers of tubercle bacilli that are found in the sputum of a tuberculous cow—the countless others that are scattered by her in the shed where milking is probably carried out, and one then reads Dr. Griffith's lecture, one is bound to conclude that the Tuberculosis Order is only treating the very outside edge of this subject.

My honest belief is that it is up to the veterinary and medical professions to combine in a vigorous propaganda, demanding, if even only as a temporary measure, that, at the very least, every milk cow in the country should be subjected to a periodical clinical examination which would include a careful palpation of the udder, at the hands of a qualified veterinary surgeon. Thus we would be advocating some live measure to rid our land of the tuberculous animal at the earliest manifestation of disease, and raising the status of the veterinarian by giving him the opportunity of safeguarding the public health and so performing a great act of mercy and benefit to the nation.—Yours faithfully,

J. HOWARD JONES, O.B.E., M.R.C.V.S.

County Veterinary Inspector, Glamorgan.

The Perfect (Kennel) Lady.

TO THE EDITOR OF THE VETERINARY RECORD.

Sir,—During the showing of a topical film recently, the audience were treated to a few scenes of girls being trained as kennel maids ; we were informed that the students were given a course in Veterinary Science and subsequently we were shown a girl taking a dog's temperature holding the thermometer in the animal's mouth.

Surely this is a new method of taking temperatures in animals ? One wonders who teaches these girls their Veterinary Science, what other startling innovations are being introduced, and, in the case mentioned, what the difference is in breakages compared with the time-honoured method.—Yours faithfully, R. A. WILLETT.

Staines.

1*st January*, 1928.

The Editor acknowledges the receipt of the following :

Communications from Capts. J. Conner, H. E. Cross and H. E. Hornby, Messrs. F. T. Harvey and D. E. Wilkinson.

Report on the Veterinary Department, Government of the Gold Coast, for the period April, 1926—March, 1927.

Report of the Medical Officer of Health of the City of Salford for the year 1926.

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